Understanding Humanity's Damaged Future

William R. Catton, Jr, ***Washington State University***

Abstract

The notion that social facts can be caused only by other *social* facts is obsolete. Human societies today are affected by biogeochemical change. "Developed" human societies so overuse the finite planet they share with "underdeveloped" societies that the future of all is threatened.

Medicine's *prosthesis* concept becomes useful for sociology when extended beyond referring to devices for replacing lost body parts or restoring impaired sensory powers. If we regard all modern tools and machines as prosthetic devices, we see them enabling humans to act as giants—giving us colossal resource appetites and huge environmental impacts.

Prosthetic apparatus (and familiar assumptions) previously useful are subject to obsolescence. But there is cultural lag. Conceptual habits restrict the way we see our world. The bubble of twentieth century experience obstructs our understanding of the future into which we giants are plummeting. To explain severe hardships ahead in the twenty-first century, sociologists need to break out of our discipline's traditional conceptual bubble. Twentieth century expectations have become misleading. The basis of past progress (a carrying capacity surplus) is gone, replaced by a carrying capacity deficit. Earth's diminished carrying capacity will sustain fewer (dinosaur-equivalent) *Homo colossus* than original *Homo sapiens*.

As the 44th president of the United States said in his inaugural address, we cannot "consume the world's resources without regard to effect. For the world has changed, and we must change with it." It is important for sociologists to explore the world's change and elucidate the implications for human societies.

For several decades my colleague Riley Dunlap and I have sought to persuade sociologists our discipline can no longer afford adherence to the restrictive notion that when explaining social phenomena we must cite only *social* facts as causal (Catton and Dunlap 1978). Human societies have come to a time when biological, geological, physical, chemical, and other classes of phenomena have undeniable sociological relevance (Youngquist 1997).

Both the public and sociologists do seem to be putting behind us as archaic blunders the racist notions once so determinative of societal structure.

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It is fundamental to sociology that all living varieties of humans are one biological species, *Homo sapiens*.

But cultural differentiation continues to operate. It has subdivided the world's human population in ways that make it sociologically meaningful to speak of two distinguishable "subspecies." The two types are not differentiated genetically, but are so different in their ecological relations to the biosphere (Zimmer 2008) that in our time we have been brewing a predicament analogous to what occurred in parts of Europe and the Middle East several tens of thousands of years ago when two coexisting human species (*Homo neanderthalensis* and *H. sapiens*) competed in a shared habitat (Sarmiento, Sawyer, and Deak 2007:18–23, 215–216).

Mindful of many ways the high-energy civilization achieved in the twentieth century (Cottrell 1955) had separated modern peoples from their conspecific contemporaries living low-energy lifestyles, I began about three decades ago referring to people in the industrialized world as *Homo colossus* (Catton 1980:155ff.)—to reflect our gigantic per capita resource appetites and environmental impacts. But our situation is unlike that of our ancestors who successfully outcompeted their Neanderthal neighbors. After Neanderthals went extinct, our *H. sapiens* ancestors continued to thrive in a world with ample carrying capacity for biologically modern but not-yet-colossal humans. Today's humans (both colossal and non-colossal) are living on a planet with damaged and diminished human carrying capacity (Asimov and Pohl 1991; Colborn, Dumanoski, and Peterson Myers 1997; McMichael 1993). So there is no certainty that the "more advanced" societies will outlast their less colossal brethren. What we have supposed were our advantages over tribal peoples are turning out to be disadvantageous to everyone.

Habitat Loss

Many species have become extinct through habitat loss. If we lose the habitat required by our species, consequences will be disastrous. What can we do when we recognize planet Earth is no longer "big enough" to support us all? Emigration was the safety valve when Europe found itself facing a serious carrying capacity deficit. That's why each year we observe Columbus Day. But Earth is finite, and we are already overusing it (Starke 2007). And we remain disinclined to do the simple arithmetic to understand the magnitude of this problem.

So far, none of the humans who have ever stepped onto land elsewhere in the solar system were emigrants. All have returned to Earth—after just brief visits to the Moon. Their journeys thence duly amazed those of us remaining behind. They were very costly trips, not only in monetary terms but in terms of the energy expended to convey men called "astronauts" merely to the very

nearest other body. We are not anywhere near being able to send surplus members of the species *H. colossus* into mass emigration, the way people from Europe historically escaped their carrying capacity deficit by emigrating (e.g., the two million Irish escaping the nineteenth century potato famine by coming to the United States). To export only as far as the moon just the annual increment of world population would require the equivalent of roughly 60,000 Apollo launchings *daily* (Catton 1980:192).

By our colossal ways we are, in effect, shrinking our habitat. Overusing our planetary home is reducing its human carrying capacity. Earth's nonrenewable resources are being depleted by a growing human population with resource appetites that have continued to increase beyond global carrying capacity. It's not just oil company greed that made fuel for our cars cost more than it used to. Hydrocarbons were buried by prehistoric geological processes long before there were profit-seeking oil or coal barons to persuade us we should extract and burn them to obtain the colossal amounts of energy we've grown accustomed to using. Because coal and petroleum are combustible and release usable energy when burned, it was natural that our recent ancestors' "definition of the situation" considered them *fuels*—destined for us to burn, rather than recognizing them as naturally *sequestered* carbon, its burial having endowed the planet we inhabit with an optimal atmosphere.

We should not wonder why crude oil prices rose above $100 a barrel. There is still a debate going on as to whether the rate of extraction of oil from the Earth will soon peak or has already peaked (Deffeyes 2005). Even the oil companies know enough not to insist peak oil is still way off in the distant future. What should really have told us life in the twenty-first century could not simply prolong lifestyles of our twentieth century high-energy bubble was the fact that *per capita* oil extraction has been *declining* ever since about 1980. Increments to reserves from additional drilling, despite improved methods of exploration, have lagged ever farther below rates of extraction and use (Heinberg 2003, 2006).

Worse yet, fossil energy empowered our societies to use even the renewable resources faster than their rates of renewal. Depletion of forests and fisheries by overharvesting is serious, as is loss of fertile topsoil by man-caused erosion. The nature of the biosphere upon which our lives depend is being changed by unintended but inexorable consequences of modern human resource use, end-product disposal, and our myriad other activities.

The more obvious it becomes that we are both too colossal and too numerous, the more we become subject to what I have called redundancy anxiety (Catton 1996/97). Each thoughtful human is now potentially haunted by the implicit question: Am I part of the surplus, or is it just all those others? As we go through the demographic bottleneck of this twenty-first century's

narrowed life-support, the most important health care specialty may be psychiatry—to deal with such festering anxieties.

Creation of *Homo colossus* by Prosthetics

When I was a boy, the Oz books, by L. Frank Baum, were among the escapes to a fantasy world (provided today, apparently, by the *Harry Potter* books). The story of *The Wizard of Oz* was brought to life by Hollywood, with human actors made up to play the roles of Tin Woodman, Scarecrow, and Cowardly Lion, the three characters who accompanied young Dorothy and her dog Toto, blown into the land of Oz by a tornado, as she followed the yellow brick road to the Emerald City, in quest of the Wizard's help to get her back home to Kansas.

In Baum's story, the Tin Woodman was the product of multiple wounds inflicted upon an ordinary man named Nick Chopper against whom a grudge was repeatedly indulged by the Wicked Witch of Oz's eastern quadrant. One by one, Nick had body part after body part replaced by a metallic prosthesis after he'd been made to wound himself wielding his own axe. As an ultimately complete assembly of metal replacements, he journeyed with Dorothy to the Emerald City to seek from the Wizard a prosthetic heart. Despite metallic make-up, the movie Tin Woodman looked more human than the images in our heads from Baum's description. Perhaps that is why it was not until years later that the word "prosthetics" entered my vocabulary. But even without that word, we kids understood the idea of artificial replacements for limbs lost to accidental injury. We knew about the wooden leg of Long John Silver in the *Treasure Island* story, and in the story of *Peter Pan* there was the prosthetic device at the end of one arm of Captain Hook. Replacement structures to renew lost functions.

The Scarecrow wanted from the Wizard a prosthetic brain. The Cowardly Lion desired something a little more abstract—prosthetic courage. For purposes of this article I want to extend the prosthesis concept in a rather different way, which I submit is less fantastic than the provision of artificial brains or courage, and may be usefully heuristic. In lectures to sociology students I used to ask them to think of the university library as a prosthetic memory, making it unnecessary for humans to have brains large enough to store internally all that accumulated knowledge (which would even prenatally require heads too big to pass through the birth canal).

Before I retired from university teaching, there were nights when I sometimes had sleepless hours mulling over some issue scheduled to come up in a faculty meeting, or points I wanted to make in the next day's lectures. It was helpful occasionally to get my mind onto other matters by listening for a while to a 24-hour news station on the bedside radio. To do this without

waking my wife, I used a tiny earphone plugged into my ear, so the sound from the radio was confined within my head. It occurred to me one night that this was basically just a hearing aid, except that it was a device for overcoming distance rather than deafness. I was listening to a station a thousand miles away. A hearing aid is a prosthetic device to give back lost auditory power. My radio with earplug, I suddenly recognized, was a prosthetic device giving my ear *long-range* hearing powers nobody ever had before modern electronics.

The night that particular thought occurred to me, it did not help me get back to sleep. Instead, because I'd had an "Aha! moment," I began to contemplate many other cultural artifacts as prosthetic devices (and built a lecture around the idea). Glasses or contact lenses prosthetically sharpen vision that the natural lenses inside our eyes can't quite provide. We think of prostheses as makeshift substitutes for damaged or missing original equipment that had been engineered by nature. But recall another fantasy from childhood—seven-league boots. Magic footwear enabling the wearer to make gigantic strides appeared in tales common to several European cultures. New structures to *amplify* functions. In real life, especially for Americans from early in the twentieth century onwards, the automobile functioned for us in this way, so that the territory over which we might range in our daily activities was much more extensive than it had been for our ancestors. Now, as gasoline prices have escalated, the commuting distances we once "took in stride," and to which the growth of cities committed us, are becoming insufferably costly.

Not just cars, but all transportation devices can be considered as prostheses enabling humans to be vastly more mobile than was possible with ordinary legs, before the technology of railways, ships, and airplanes came along. In today's air travel, we no longer imagine attaching feathered wings to our shoulders, as in the story of Daedalus and Icarus, to achieve individual flight. We buy tickets, board a metal-winged airliner, and strap it to our waists, availing ourselves of the power of jet engines to propel us at 500 miles per hour from point A to some chosen point B. Those jet engines are prosthetic muscles. The airliner's fuel tanks are prosthetic stomachs. More later about feeding those stomachs. So, as *H. colossus*, we are like Super Tin Woodmen—consisting of ability-*enlarging* prostheses on a grand scale.

But let's go back to the Cowardly Lion's desire for a courage prosthesis. I'm not sure what modern cultural artifact would fit that description, but no less amazing is the fact that we do have an immune system prosthesis for those rare instances in which a newborn human infant suffers from SCID—Severe Combined Immunodeficiency. The pediatric immunologist may prescribe an infusion of intravenous immune globulin (IVIG) and possibly a stem cell transplant. By implication, cells from another organism are called upon to function as prostheses on behalf of an organism deficient in certain

essential cells. In extreme cases, the patient may for a time have to be enclosed in a plastic "bubble" within which sterilized air and nutrients can be provided. Such a device was created several decades ago by immunologist Rafael Wilson to contain a young patient named David Vetter within a germ-free "isolator" (Lawrence 1985).

To me it seems reasonable to think of that bubble as a prosthetic substitute for the boy's missing immune system.

Why is this important to sociologists? Because we can turn the metaphor around. Our immune systems are the normal organic equivalent of that isolating bubble. The task of defending us from invading bacteria or viruses is what makes the artificial bubble and our white blood cells functional equivalents. There is a vital counterpart to this on the level of societal, rather than organic, phenomena. We humans are what we are not only because of our genetic endowment but also because of our cultural endowment. As we grow up, interacting with other humans, many of whom grew up ahead of us, the very process of interaction builds into us a vocabulary, conventional patterns for combining words into sentences, ways of thinking, concepts by which to perceive our surroundings, our experiences, our place in a social structure, etc.

People in different societies are of course socialized somewhat differently, but in each society they internalize norms and expectations characteristic of that society, or of some smaller segment within that society. Because of what we have internalized in this process, the foreign ways and different expectations of people in other settings come to seem strange, even abnormal. We *naturally* accord priority to the ways with which we are most familiar. It is this very natural feeling that familiar ways are more reasonable than foreign ways that we sociologists call ethnocentrism.

Sociology has perhaps not sufficiently noted that ethnocentrism functions culturally much like the immune system functions biologically. Ethnocentrism gives an important assist to the enforcement of in-group norms of behavior. Any temptation to behave in ways not "natural" to our own society, however "natural" different ways may be elsewhere, is inhibited by the very natural ethnocentrism we develop as socialized beings. That inhibition is normally healthy for a functioning society. People who don't fully internalize their society's norms sometimes have to be coerced into conforming. So gossipers and cops may be seen as prostheses for insufficiently internalized ethnocentric inhibitions.

Having grown up in America, my food tastes are American. I find it hard to imagine eating some of the things people enthusiastically eat in some other parts of the world—even in cultures not really very different from mine. I know that escargot is considered a delicacy in France, but ethnocentrism makes it difficult for me even to consider eating snails myself. A waiter in a

restaurant in Paris frowned at me most ethnocentrically when I ordered milk instead of wine with my dinner. A Norwegian friend of mine disliked American milkshakes, and a friend in New Zealand regarded with disdain putting syrup on pancakes.

Those particular inhibitions don't much matter in our quest for amicable international relations, but in this jet age contacts between different cultures are greatly multiplied, and the occasions when ethnocentrism must be somehow overcome (or put aside) are increasingly numerous and potentially serious. Isn't this analogous to the need in an organ-transplant patient to block or curtail the immune response? In earlier times, immune reactions were generally "a good thing,"—except for autoimmune diseases, of course. Likewise, when the world was less crowded, and people less mobile, ethnocentrism was generally OK. Now, there are more instances in which we need ways to suppress normal ethnocentrism. We need some social equivalent of the anti-rejection drugs required by organ-transplant patients.

But consider again that bubble surrounding a SCID patient—hopefully only as a temporary expedient. Even as adults, going about our normal activities, we are ALL in bubble-equivalents. Ethnocentrism applies not just to the natural predilection to favor the ways of our own nation or class over the different ways of other contemporaries. It applies to our tendency to regard the world of our own time, which is naturally familiar to us, as more normal than the less familiar world of the past—or of the future.

Those of us who grew up in the twentieth century had many "advantages" over people living in earlier times. It has been altogether natural for us not to see the serious beyond-the-horizon disadvantages for later generations that were inherent in those advantages. So now, in the twenty-first century, we are finding we have bequeathed to our posterity a world in which life will perforce be quite different. Now that commuting to work is becoming too costly, there will be pressures in the years ahead to restructure our cities, reducing average distance between residences and places of work. But cities can't be replanned or rebuilt overnight. It will be a dragged out process, painfully so. And this particular restructuring of our lives will be only a small part of the challenge of the present century. In myriad ways not easy to imagine, life could well return to being "nasty, brutish, and short," in the famous phrase of Thomas Hobbes.

Why so? Because of three trends that have together reached a level of combined destructiveness.

First, we humans are vastly more numerous than we used to be. All the medical advances that so greatly reduced infant mortality and magnificently increased life expectancy had the side effect of raising the rate of natural increase in human numbers (even as birth rates declined). Within our bubble

we who grew up in the twentieth century took it to be altogether natural that there have been fewer deaths than births in each year of our lives. Too seldom did we ask: Where will this positive rate of natural increase take us? But there are now more than three times as many people using this finite planet as there were when I was reading about that Tin Woodman. Three times as many of us competing for limited space and exhaustible resources—a fantastic change within one human lifetime!

Second, we humans with all our prosthetic extensions have become effectively not just life-size Tin Woodmen, but each of us is effectively a much *larger* person-with-technology complex. We are, in effect, huge compared to humans a few generations ago. Think about how far we have carried our Tin Woodman dependence on prosthetic extensions! Next time you are in a car and find yourself sharing a highway with big trucks, think of what the billboard advertising that industry says: "Whatever you've got, a truck brought it." Notice the exhaust spewing from one of the pipes sticking up on the back of the truck's cab. Then think of the difference between a *H. sapiens* biological nose and the metal nostrils of the mechanical devices that make your accustomed *H. colossus* lifestyle possible. Our per capita resource appetites and our per capita effects upon the biosphere are huge compared to our far less prosthetic ancestors.

And third, being human, which means we are naturally ethnocentric, we remain disinclined to see the longer-range consequences of our accustomed ways, and reluctant to forgo the obvious blessings of technological progress. We resist practicing the amount of self-restraint that would avoid or abate those consequences.

In and Out of Bubbles

We all live inside of conceptual bubbles that restrict the way we see our world. Because of that, we don't usually, for example, apply the title of "Great Emancipator" to Christopher Columbus, although much of what we have considered freedom resulted from his voyage of discovery. As people from Europe availed themselves of the spatial and physical resources of a "New World," it was easier to be free from old-country constraints. Nor is the ecological concept of "carrying capacity," which is well known to wildlife managers and livestock men, as familiar as it needs to be to the rest of us. It is not included in the working vocabulary of most politicians, who live in a different professional bubble. But the importance of this concept, and the true social impact of the 1492 voyage must be recognized by the public (and especially by sociologists) if there is to be any hope of releasing our minds from the bubble in which we have collectively entrapped ourselves by the great progress we achieved in the twentieth century.

By discovering a "New World," Columbus helped change the relation of European humans to the carrying capacity available to them. This change revolutionized western civilization and had much to do with shaping our customary way of thinking about the future. When I was growing up, and when my sons were growing up, and perhaps even to some extent during the childhood of my grandchildren, conventional wisdom included the expectation that each generation would have a more abundant life than had been the lot of its parents and grandparents. That was a thoroughly plausible attitude when there was still a conspicuous carrying capacity surplus.

Now we are encountering another change in the relation between human users of this planet and its carrying capacity for their uses. But the bubble of twentieth century experience obstructs our understanding of the future into which we are plummeting. The world we are now struggling to understand has begun to feel the effects of a carrying capacity deficit. We humans have overloaded the world. It has become a world that can subject children to socialization in an environment charged with sentiments of despair and rage. Such an environment was perhaps epitomized in a street scene shown in a half-page magazine photograph I saw back in the 1970s (*New Society 1973*: 331). Standing near a parked truck in some urban area was a small boy, visibly young enough to have much of his character-forming socialization ahead of him. On a dilapidated wall behind him there were large letters someone had scrawled with aerosol paint. They spelled out three stark sentences:

> I don't believe in nothing.
> I feel like: They ought to burn down the world.
> Just let it burn down, baby.

The changed world of our twenty-first century is one in which the outlook of people in many nations will tend to be more similar to such graffiti in a city under siege than to the visions of an ever-brighter future common to my boyhood years. Only by getting out of our ethnocentric bubble can today's adults begin to understand why the world's people increasingly feel besieged. In the twenty-first century it is not going to be as easy to be optimistic as it used to be. The future does not seem to be what the future used to be. Young people had largely ceased to assume that science is normally beneficial to mankind (Beale 1973), and it remains to be seen how extensive and lasting the restoration of hope reflected in the installation of a new administration in Washington will be.

To understand our future and its probable impact on our activities we need to be less anthropocentric in our view of the world than we were when a temporary surplus of carrying capacity shaped the intellectual climate. Anthropocentrism—perceiving everything in humanlike or human-centered

terms—is a form of ethnocentrism for, as humans, we find it quite natural to be human-centered in our ways of thinking about the world around us. But now we need to recognize the mind-stopping effects of anthropocentrism. It has been a fundamental feature of our bubble. Instead of always taking the word "communities" to mean towns or cities (or neighborhoods, professions, or ethnic categories), we must embrace the ecologist's usage: communities are associations of interacting populations of diverse organisms. Instead of insular attention to "social systems," we must become attuned to "ecosystems" as modern biology uses the term. Then we can comprehend the ultimate relevance of carrying capacity and begin to fathom the societal consequences of a deepening carrying capacity deficit.

Ecological Revolution and Unforeseen Counterrevolution

Consider the bubble for pre-Columbus Europeans. For almost ten thousand years, since people in the fertile crescent between Europe and Asia (the area we now know as Iraq) had discovered they could manage the growth of plants for food (and thus had changed themselves from foragers to farmers), the number of humans walking the surface of this planet had been increasing at a greater average rate than ever before. But the pace had been still almost glacial in comparison with more recent experience within our lives. Each of the six doublings of the world's total human population between the dawn of agriculture and Columbus's time took an average of about one and a half thousand years. In any one individual's lifetime, then, change in population density would have been essentially imperceptible.

Accordingly, those people viewed the future without much expectation of change. Progress was hardly conceivable to them. The population of Europe had inched its way up to an approximate equilibrium with the carrying capacity of the European continent—the number that land mass could support more or less in perpetuity with the then-existing state of the arts. When a "New World" became known, that knowledge burst their bubble. Monarchs and entrepreneurs soon began to make the newly discovered lands "available" for European use and settlement. Previously untapped resources began to be used by Europeans. Carrying capacity for European lifestyles was greatly enlarged.

Here is the measure of what getting out of the prior bubble meant. When Columbus set out across the Atlantic there had been about 24 acres of Europe per European. After continents in another hemisphere became available for settlement and exploitation, there were some 120 acres of land per European. Broadly speaking, the effect of Columbus's serendipitous discovery was a five-fold increase in the apparent carrying capacity of the European's total potential habitat. Thus, for the first time in human memory, opportunities seemed "limitless."

The surplus carrying capacity of the enlarged world was to be the big fact shaping all facets of life in post-Columbian times. Vast as they were, however, the lands previously unknown to Europeans were finite in number and extent. Although Columbus's big discovery was augmented a century and a half later when Abel Tasman discovered Australia and New Zealand, people could not continue finding, and making accessible, new hemispheres. When geographic discovery was essentially complete, however, there remained other ways to raise still further the population ceiling for European *H. sapiens*. The Industrial Revolution and improvements in agriculture enabled mankind in both hemispheres to use an increasing fraction of the earth's substance. Technological progress—for a while—extended the enlargement of human carrying capacity.

Discovery and invention wrought a human ecological revolution. It had profound social consequences. With a huge carrying capacity surplus available, new freedoms became common and new institutions emerged. When abundance seemed limitless, *H. sapiens* was free to become *H. colossus*. In a burst of progress new ways were found to use previously unavailable or unusable substances—equivalent sometimes to converting non-resources into resources. But the social changes people witnessed and encouraged (or resisted) were easily misconstrued. The phrase "carrying capacity" was yet uncoined, so the dependence of welcome progress on a carrying capacity surplus could hardly be discerned. The land of opportunity became our new bubble, within which the idea that there might someday not be the blessings of a surplus was unthinkable. There was no incentive to apply human imagination to considering what life would be like after the surplus was depleted. But we had reverted to foraging, on a colossal scale, for the fuels and mineral resources we had come to require. The fact of surplus was taken for granted and assumed to be forever. Within this bubble no post-surplus counterrevolutionary change could be foreseen.

We need to understand certain ideas to get out of our bubble. The needed ideas should not be as difficult as we let them seem.

1. All life involves taking nutrition from our surroundings, chemically transforming it in our bodies by the processes of metabolism, emitting transformed end-products. It is a simple fact of life that any organism (and any population) must have an environment to use in three ways: all living things—including animals, including humans—need
   a **source** of sustenance,
   activity space,
   and a **disposal** site.

2. The **SAD** fact of life is that the more of us there are, using Earth ever more voraciously as a **S**ource of sustenance, as **A**ctivity space, and as a **D**isposal site, the harder it becomes to keep these three functions segregated from each other so they do not interfere with one another.
3. But the more we became committed to living as *H. colossus*, an overwhelmingly prosthetic species, the more our outside-the-body metabolism became dominant.
4. Fuel and mineral resources to feed our technological apparatus became as important as food to feed our flesh-and-blood bodies. We reverted to being foragers, now on a *colossal* scale. And this technological civilization generated a vast new "waste stream" requiring disposal.

How Colossal Have We Become?

In 1932, Swiss-born-and-educated agricultural chemist Max Kleiber, whose doctoral thesis was titled "The Energy Concept in the Science of Nutrition," reached the conclusion as a member of the Animal Husbandry department at UC Davis that the 3/4 power of body weight was the most reliable basis for predicting the basal metabolic rate of animals (Kleiber 1947). His formula would enable comparing nutrient requirements among animals of different size. But when a creature's energy use (metabolism) is known, Kleiber's equation can be solved in reverse to estimate body size.

On average today, the people of the world use exosomatically about ten times the energy (from fuels, etc.) that they use endosomatically by their bodies' metabolism and muscular actions. We Americans use much more energy per capita than the human world average use. Much of the fuel that powers our myriad engines was formed long ago in the Earth's crust by geological processes from buried prehistoric vegetation. The dependence of *H. colossus* on importing energy from else*when* (i.e., from the Carboniferous period) is a more fundamental aspect of today's human predicament than our reliance on importing fuel from else*where* (e.g., the Middle East). Seeking "independence from foreign oil" is not enough; the dependence of *H. colossus* on fossil fuels (from *anywhere*) cannot last—a sociologically profound fact.

More than 20 years ago I applied Kleiber's equation to total per capita energy use (both inside and outside their bodies) by people in different cultures at different times in history to derive estimates of the size of creature to which each energy-using human was equivalent. My findings were published in the journal *BioScience* in June 1987. The estimated world population of only 3 million people around 35,000 B.C. used just enough energy (in their bodies and their fires) to be equivalent to Common Dolphins.

Twenty-seven thousand years later, in 8,000 B.C., when there were an estimated 8 million people who made some use of animal power, wind, and river currents, to supplement their fires and their metabolism, each was on average equivalent to a somewhat larger Atlantic Humpbacked Dolphin.

The rate of population growth accelerated after the dawn of agriculture, so that by 1500, on the brink of European expansion into the New World, there were 350 million humans, each the average energy equivalent to the still larger Risso's Dolphin.

Only three centuries after this, in 1800 A.D., as the Industrial Revolution was just beginning to exploit fossil energy for an expanding repertoire of activities, there were almost one billion humans, each on average now the energy-converting equivalent to a Beluga Whale. Henceforth many of the world's people, as fossil fuel users, would become *H. colossus*, some more colossal than others, of course.

By 2000 A.D., by more than a six-fold increase in only two more centuries, Earth's human population reached six billion. And average *per capita* energy use worldwide was now more than a dozen times what it had been back in the days of our Common Dolphin-equivalent ancestors. The *load* imposed by all of humanity on the global ecosystem had enlarged in the last two centuries more than fifteen-fold—a fact not widely realized!

By now we Americans were using so much energy—mostly from fossil fuels, especially oil—that we were each equivalent on average to a full-grown Sperm Whale, making each of us ecologically comparable to 16 of our colonial-era ancestors. One should not think of the United States as a big country populated by just 300 million ordinary people, grim as even that image may seem to any of us old enough to have personal memories of our country being less than half that populous. It's hard to think of an aquarium (or even an ocean) filled with 300 million Moby Dick sized whales.

But now, with many paleontologists tending to believe dinosaurs, more like their bird descendants and unlike other reptiles, were possibly warm-blooded, it is plausible to apply the Kleiber equation to yield a *land*-animal image of American *H. colossus*. Yes, the USA is big, sprawling across more than 3.5 million square miles. But the "metabolic" load of 64 colossal humans per square mile means there are only ten acres apiece to support each of us 41-metric-ton "dinosaurs." That's not enough habitat for a creature with resource demands so prosthetically monstrous. So (as we already know), we have come to depend on ravenously importing carrying capacity from other parts of the planet. We *H. colossus* forage on other people's territories, almost oblivious to what it means that we have reverted to being foragers, dependent again upon limited resources nature happened to provide unguided by our wants.

We sociologists *must* burst this latest bubble. If societies are to minimize in the twenty-first century the die-off that normally befalls populations confronting a carrying capacity deficit, serious downsizing of *H. colossus* must occur. Sociologists should be helping to explain why, rather than dismissing such matters as outside the boundaries of our discipline.

ENDNOTE

Please direct correspondence to William R. Catton, Jr., Washington State University, 12108 Gravelly Lake Dr., S.W., Lakewood, WA 98499-1416, USA; e-mail: wrnlcatton@mac.com

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